CLAIMS

What is claimed is:

1. A method for preparing an anode slurry, comprising the steps of:

1) mixing a dispersant with a first solvent to form a dispersant solution;

2) dispersing a silicon-based material and a first conductive agent in the dispersant solution to form a first suspension;

3) homogenizing the first suspension by a homogenizer to obtain a homogenized first suspension;

4) mixing a binder material with a second solvent to form a binder solution;

5) dispersing a second conductive agent in the binder solution to form a second suspension;

6) mixing the homogenized first suspension with the second suspension to form a third suspension; and

7) mixing a carbon active material with the third suspension to form the anode slurry;

wherein the particle size of the first conductive agent is smaller than the particle size of the second conductive agent;

wherein the silicon-based material has a particle size from 10 nm to 800 nm;

wherein the particle size of the first conductive agent is from 20 nm to 100 nm;

wherein the particle size of the second conductive agent is from 1 μm to 10 μm;

wherein the particle size of the second conductive agent and the particle size of the first conductive agent are in a ratio from 20:1 to 250:1; and

wherein the silicon-based material is selected from the group consisting of Si, SiO_x, Si/C, SiO_x/C, Si/M, and combinations thereof,

wherein each x is independently from 0 to 2; and

wherein M is selected from an alkali metal, an alkaline-earth metal, a transition metal, a rare earth metal, or a combination thereof, and is not Si.

2. The method of claim 1, wherein the dispersant is selected from the group consisting of polyvinyl alcohol, polyethylene oxide, polypropylene oxide, polyvinyl pyrrolidone, polyanionic cellulose, carboxylmethyl cellulose, hydroxyethylcellulose, carboxymethyl hydroxyethyl cellulose, methyl cellulose, starch, pectin, polyacrylamide,

gelatin, polyacrylic acid, and combinations thereof.

3. The method of claim 1, wherein the viscosity of the dispersant solution is from 10 cps to 2,000 cps.

4. The method of claim 1, wherein each of the first and second solvents is independently selected from the group consisting of water, ethanol, isopropanol, methanol, acetone, n-propanol, t-butanol, N-methyl-2-pyrrolidone, and combinations thereof.

5. The method of claim 1, wherein the first conductive agent is selected from the group consisting of carbon, carbon black, acetylene black, graphene, graphene nanoplatelets, carbon fibres, carbon nano-fibers, graphitized carbon flake, carbon tubes, carbon nanotubes, activated carbon, mesoporous carbon, and combinations thereof.

6. The method of claim 1, wherein the particle size distribution of the first suspension has a D10 value in a range from 10 nm to 100 nm, a D50 value in a range from 30 nm to 2 μm, and a D90 value in a range from 70 nm to 3 μm.

7. The method of claim 1, wherein the D90/D50 ratio of the particle size distribution is less than 2:1.

8. The method of claim 1, wherein the second conductive agent is selected from the group consisting of carbon, conductive graphite, vapor-grown carbon fiber, expanded graphite and combinations thereof.

9. The method of claim 1, wherein the carbon active material is selected from the group consisting of hard carbon, soft carbon, graphite, mesocarbon microbeads, and combinations thereof.

10. The method of claim 1, wherein the particle size of the carbon active material is from 1 μm to 20 μm.

11. The method of claim 1, wherein the weight ratio of the silicon-based material to the first conductive agent is from 1.7:1 to 5:1.

12. The method of claim 1, wherein the weight ratio of the first conductive agent to the second conductive agent is from 1:1 to 2:1.

13. The method of claim 1, wherein the amount of the silicon-based material is from 1% to 20% by weight, based on the total weight of the solid content in the anode slurry.

14. The method of claim 1, wherein the amount of the first conductive agent and second conductive agent in the anode slurry is greater than or equal to 3% by weight, based on the total weight of solid content in the anode slurry.

15. The method of claim 1, wherein the anode slurry has a solid content from 30% to 65% by weight, based on the total weight of the anode slurry.